

# Extending NTON High Performance Capabilities

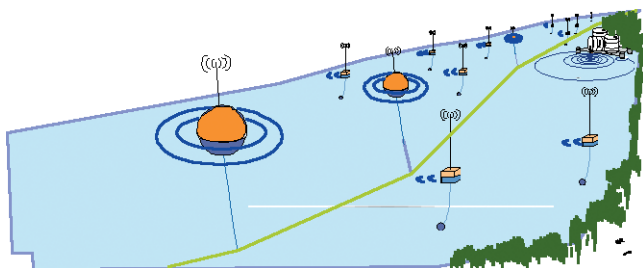
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**We are using the technology and capabilities LLNL developed initially for the National Transparent Optical Network (NTON) to define the information and communications technology infrastructure needed to monitor large-scale water systems**

The proposed system will deploy fixed, networked sensors throughout waterways. Real-time measurements would be input to advanced simulation models used to characterize and predict complex environmental processes. Timely collection and insertion of sensor data into “live” simulation models will enable models to “learn” about the details of environmental media, to adapt and reconfigure for rapidly-changing conditions, and to “train” dynamic mobile sensor configurations to optimize the quality and utility of information.

Through data fusion with related information such as rainfall and satellite observations this modeling oriented “monitor” system would detect anomalies, predict consequences and outline detailed measurement scenarios. Typically, a large number of floating, wireless network sensors with position tracking capabilities would be deployed upstream of any sensors detecting an anomaly (Fig. 1). This self-organizing network would report enough additional information to compute the plume profile and predict the likely contamination source.

This problem can now be addressed because of a confluence of developments. Computing power continues to double and cost reduction to be cut in half every 18 months. Wireless communication systems are becoming



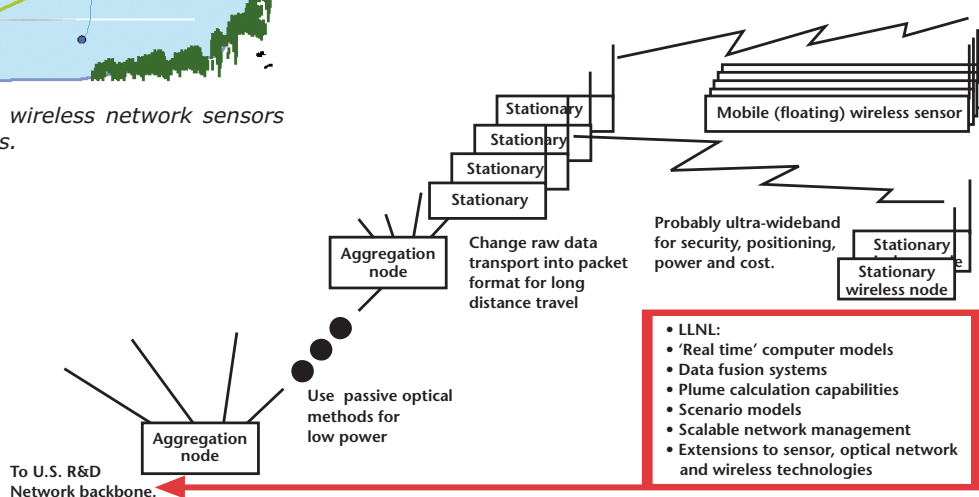
**Figure 1.** Depiction of floating, wireless network sensors with position tracking capabilities.

smaller, cheaper, adaptive, and more seamlessly connected with the Internet and other ubiquitous communication channels. Similarly, environmental sensors, including those developed at LLNL, are becoming smaller, smarter, cheaper, less invasive, and lower power. Finally, ClearStream Communications, Inc. has developed and is installing a diversely routed national “fully optical” fiber-optic communications network throughout various riverine and coastal waterways of the US and neighboring countries.

The network (Fig. 2) has been designed to allow concurrent deployment of both a commercially viable, advanced optical network (>1 Gb/s end user access) and a network foundation for a national riverine and coastal monitoring system.

The first phase is the deployment of a test-bed to demonstrate the waterway emplacement technology, to test the sensor and data network architecture, and to build a regional test platform connected to US research networks. The resultant network will field-test new sensor and optical network technology; provide connectivity to the national R&D network backbone; and prototype environmental, water integrity, and waterway security applications. The initial applications will require simple sensors for environmental monitoring and video to demonstrate security capability. The initial optical technology will be Optical Code Division Multi-Access transport of Ethernet.

Preliminary high-level designs and initial interactions with the applications scientists and potential users led to the initial deployment plan. First, the test-bed will be deployed at LLNL with a leg to San Francisco Bay. Second, a longer water deployment will take place in Chesapeake Bay. Finally, a full Chesapeake Bay deployment will link Baltimore, Washington, Norfolk, and intervening sites to each other, and also to the national network backbone.



**Figure 2.** Proposed system to deploy fixed, networked sensors throughout waterways.